

CLAIMS

1. A piezoelectric ceramics having ceramic particles, wherein:

5 said ceramic particles comprises

bismuth layer compound containing at least Sr, Ln (note that Ln is a lanthanoid element), Bi, Ti and O and including $M^{II}Bi_4Ti_4O_{15}$ type crystal (M^{II} is an element composed of Sr and Ln) as a main component, and

10 an oxide of Mn as a subcomponent; and

an average particle diameter by the code length measuring method is 0.8 to 4.7 μm .

2. The piezoelectric ceramics as set forth in
15 claim 1, wherein said $M^{II}Bi_4Ti_4O_{15}$ type crystal is expressed by a composition formula $(Sr_\alpha Ln_\beta)Bi_\gamma Ti_4O_{15}$, and "α" satisfies $\alpha = 1 - \beta$, "β" satisfies $0.01 \leq \beta \leq 0.50$ and "γ" satisfies $3.80 \leq \gamma \leq 4.50$.

20 3. The piezoelectric ceramics as set forth in claim 1 or 2, wherein a content of said oxide of Mn is 0.1 to 1.0 wt% in terms of MnO.

4. A piezoelectric element, comprising a
25 piezoelectric substance formed by the piezoelectric ceramics as set forth in any one of claims 1 to 3.

5. The piezoelectric element as set forth in claim 4, wherein a maximum value Q_{max} of "Q" ($Q = |X|/R$,
30 wherein "X" is reactance and "R" is resistance) between a

resonant frequency and an antiresonant frequency with respect to a third harmonic wave of thickness vertical vibration at 24 MHz is 8 or larger.

5 6. A piezoelectric ceramics having ceramic particles, wherein:

 said ceramic particles comprises

 bismuth layer compound containing at least Ca, Ln (note that Ln is a lanthanoid element), Bi, Ti and O
10 and including $M^{II}Bi_4Ti_4O_{15}$ type crystal (M^{II} is an element composed of Ca and Ln) as a main component, and
 an oxide of Mn as a subcomponent; and
 an average particle diameter by the code length measuring method is 1.0 to 4.5 μm .

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 7. The piezoelectric ceramics as set forth in claim 6, wherein said $M^{II}Bi_4Ti_4O_{15}$ type crystal is expressed by a composition formula $(Ca_{1-\beta}Ln_{\beta})Bi_{\gamma}Ti_4O_{15}$, and " β " satisfies $0.01 \leq \beta \leq 0.5$ and " γ " satisfies $3.80 \leq \gamma \leq$
20 4.20.

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 8. The piezoelectric ceramics as set forth in claim 6 or 7, wherein a content of said oxide of Mn is 0.1 to 1.0 wt% in terms of MnO.

 9. A piezoelectric element, comprising a piezoelectric substance formed by the piezoelectric ceramics as set forth in any one of claims 6 to 8.

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 10. The piezoelectric element as set forth in

claim 9, wherein a maximum value Q_{\max} of "Q" ($Q = |X|/R$,
 wherein "X" is reactance and "R" is resistance) between a
 resonant frequency and an antiresonant frequency with
 respect to a third harmonic wave of thickness vertical
 5 vibration at 60 MHz is 6 or larger.

11. A piezoelectric ceramics having ceramic
 particles, wherein:

said ceramic particles comprises

10 bismuth layer compound containing at least Ba,
 Sr, Ln (note that Ln is a lanthanoid element), Bi, Ti and
 O and including $M^{II}Bi_4Ti_4O_{15}$ type crystal (M^{II} is an
 element composed of Ba, Sr and Ln) as a main component,
 and

15 an oxide of Mn and an oxide of Ge as a
 subcomponent; and

an average particle diameter by the code length
 measuring method is 0.4 to 3.2 μm .

20 12. The piezoelectric ceramics as set forth in
 claim 11, wherein

said $M^{II}Bi_4Ti_4O_{15}$ type crystal is expressed by a
 composition formula $(Ba_{1-\alpha-\beta}Sr_{\alpha}Ln_{\beta})Bi_{\gamma}Ti_4O_{15}$, and

" α " satisfies $0.1 \leq \alpha \leq 0.6$, " β " satisfies $0.05 \leq \beta$
 25 ≤ 0.5 and " γ " satisfies $3.90 \leq \gamma \leq 4.30$ in said
 composition formula.

13. The piezoelectric ceramics as set forth in
 claim 11 or 12, wherein

30 a content of said oxide of Mn is 0.1 to 1.0 wt% in

terms of MnO , and

a content of said oxide of Ge is 0.05 to 0.5 wt% in terms of GeO_2 .

5 14. A piezoelectric element, comprising a piezoelectric substance formed by the piezoelectric ceramics as set forth in any one of claims 11 to 13.

10 15. The piezoelectric element as set forth in claim 14, wherein a maximum value Q_{\max} of "Q" ($Q = |X|/R$, wherein "X" is reactance and "R" is resistance) between a resonant frequency and an antiresonant frequency with respect to the fundamental wave of thickness-shear vibration at 8 MHz is 23 or larger.